MODIFYING CB TRANSCEIVERS ONTO THE NEW 23-CHANNEL SYSTEM ON 10 METRES FOR ONLY $24.00

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With the national adoption of a 23-channel system on the 10 metre band and the allocation of 28.1 to 28.6 MHz for novice amateur use, and with the cost of 23-channel AM transceivers dropping to $40 and 23-channel SSB sets reaching $130, many of our newly licensed amateurs are getting into amateur radio by modifying such inexpensive 11 metre gear onto 10 metres.

The versatility of many of these modified CB transceivers has contributed to the growing local usage of 10 metres in the areas of mobile, base, pedestrian hand-held and backpack radio operation on 28 MHz. This article describes how to modify a 23-channel Hygain V from 27 MHz to 28 MHz. This transceiver uses a circuit which is identical to the Midland 13-892, the Kraco 2355, the Kraco or Universe 2340, the Sideband Electronics SE502 and SE501. Just with 12 watts PEP and a ¼ wave ground plane antenna contacts with an amateur in New York city and another in West Berlin were made soon after modifying the transceiver onto 28 MHz.

Operating the unit in a shoulder carrying bag which also contained a small 5½ ampere hour sealed battery and a 4½ foot helical antenna, the author has had hours of fun, walking around the streets of Sydney, working the 10 metre DX around Australia, waving to the passing CBers and saying hello to a few police officers. Help publicize amateur radio by operating out in the community. This article will help you get a portable HF DX station going.

As from the 1st January 1978 only 18-channel CB transceivers are licenceable for the citizens radio service. 23-channel unit licences can be renewed if they were licensed prior to that date and are in the possession of the original licence. As a result, a large number of 23-channel transceivers which are excellent for modification onto 10 metres, are available very cheaply in the "Wanted to Sell" section of the daily newspapers and in CB magazines.

CB transceivers employ three types of frequency generation. (1) The old method of two crystals per channel (one for receiving and one for transmitting). (2) The recently popular method of frequency synthesising, for which much information currently exists for modifying such units onto 10 metres. (3) The increasingly popular phase-locked loop (PLL) system which offers exciting possibilities for 10 metre modification but for which currently I have not been able to obtain any details on modification of such systems onto 10m.

27 MHz transceivers using the frequency synthesised method of frequency generation can be modified onto the 23-channel system on 10 metres by locating the 10 synthesising crystals which are found in a bank of 4 and a bank of 6 crystals. A pair of crystals, one from each bank, is selected by the channel switch. This method allows generation of all 23 channels. Only one of these banks of 4 or 6 crystals need to be changed to modify such CB units onto 10 metres.

MODIFYING THE HYGAIN V ONTO 10 METRES

In the case of the Hygain V transceiver, the bank of 4 crystals in the 14 MHz range each have a series trimmer capacitor which would need to be readjusted if this bank were to be changed. It is therefore simpler to change the bank of six 23 MHz crystals. When changing the crystals in either bank for 10 metre use, this is easily calculated by adding 1.335 MHz to the existing crystal frequencies. This is obtained from the formula: Channel 1 on 10 metres (28.3 MHz) minus Channel 1 on 11 metres (26.965 MHz). The six new crystals required to cover the 23-channel 10 metre range for the Hygain V and similar transceivers are 24.665 MHz, 24.715 MHz, 24.765 MHz, 24.815 MHz, 24.865 MHz and 24.915 MHz.

All six crystals can be obtained for a total outlay of $24 (U.S.), ($4 per crystal, postage included) from Jan Crystals, 2400 Crystal Drive, Fort Myers, Florida, U.S.A. 33901. Simply state the make and model number of your transceiver and crystals will be made to the manufacturers own specifications, list the six crystals you require and specify these as "CB synthesised crystals" to obtain this special price. Delivery is by airmail within 3 weeks. Customs duty and sales tax may be payable in addition.

Remove the old 6 crystals and note which crystal went in which socket, then solder in the 6 new crystals.

TUNING THE RECEIVER FROM 11 TO 10 METRES FOR AM AND USB OPERATION

1. Set the signal generator onto channel 13 (28.450 MHz).
2. With the switch on USB and a heterodyne note beating with the signal generator tune —

L18 the front end input RF amplifier coil
L19 the input coil to the mixer
L20 the mixer output coil
L202 the 38 MHz amplifier input coil
L203,
L204 the 38 MHz amplifier output coils.

Tune all coils for maximum S meter readings.

3. Check that each channel is operative, if the highest channel is not oscillating or if two channels are receiving a common frequency (an interesting overtone problem) then the solution in both cases is to slightly turn L201, the main 24 MHz overtone oscillator output coil.

Both USB and AM receive should be fully operative on 10 metres. The S meter circuit appears to be frequency sensitive and reads lower on 28 MHz even though the receiver does not lack any sensitivity. Adjust the trimpot RV9 for reasonable relative S meter readings.

TUNING THE RECEIVER FROM 11 TO 10 METRES FOR LSB OPERATION

1. Set the signal generator onto channel 13 (28.450 MHz).
2. With the switch on LSB and a heterodyne note beating with the signal generator tune —

L15 the 16 MHz amplifier input coil.
L16,
L17 the 16 MHz amplifier output coils.

Tune all coils for maximum S meter readings.

THE 23 CHANNEL SYSTEM ON 10 METRES

Channel Number	MHz	Channel Number	MHz
1	28.300	13	28.450
2	28.310	14	28.460
3	28.320	15	28.470
4	28.340	16	28.490
5	28.350	17	28.500
6	28.360	18	28.510
7	28.370	19	28.520
8	28.390	20	28.540
9	28.400	21	28.550
10	28.410	22	28.560
11	28.420	22A	28.570
12	28.440	23	28.590

TUNING THE TRANSMITTER FROM 11 ONTO 10 METRES FOR USB AND AM OPERATION

1. Feed in the random noise from a 2 metre FM receiver or a constant tone through the microphone of the Hygain V.
2. Set the switch to USB and channel selector to 13 (28.450 MHz) and tune:

L2 the output from the 27 MHz mixer
L3 the input from the 27 MHz preamplifier
L4 the input to the driver
L5 the input to the RF power amplifier
L6,
L7 the output from the RF power amplifier.

Tune all coils for maximum power output into a dummy load.

Both USB and AM transmit should be fully operative on 10 metres. Alignment is best carried out on USB rather than AM to achieve the 12 watt PEP level on SSB. Trimpot RV8, the SSB microphone gain control, can be adjusted fully if desired. On AM trimpot RV7, the AM microphone gain control, can be somewhat increased with the effect of improving the AM transmit audio quality.

TRANSMIT LSB OPERATION

This should be fully operative on 10 metres, if not, then using the same procedure as above, tune L15, L16 and L17 for maximum power output on LSB.

MODIFYING CB UNITS ONTO 10 METRES

As well as being frequency synthesised systems, check that coils are easy to tune before specially obtaining a CB unit for modification. The Hygain V and similar units are very easy to tune, as all coils are freely adjustable.

A GUIDE TO MODIFYING SOME OF THE 23-CHANNEL FREQUENCY SYNTHESISED TRANSCEIVERS FOR OPERATION ON THE 10 METRE BAND

Compiled with the help of VK2BK, VK2BZJ, VK2NDS, VK2NDX, VK2NEV, VK2NEJ, VK3AIH and VK4NBL.

AM ONLY

Units employing the frequency synthesised generation method:
Seiki, Midland, Realistic, Panther, Cobra, Fairmate. Existing crystals: 37.6, 37.65, 37.7, 37.75, 37.8, 37.85 MHz.

AM AND SSB

Units employing the frequency synthesised generation method:

(674B) Hygain V, Hy Range V, SE502, Kraco 2340, 2355, Midland 13-892, SE501 (these units have proved especially popular on 10 metres). Existing crystals: 23.330, 23.380, 23.430, 23.480, 23.530, 23.580 MHz. Zodiac Torus, Panther-Pearce Simpson. Existing crystals: 11.805, 11.855, 11.955, 12.002, 12.055 MHz.

Midland 13-893 and 13-895. Existing crystals: 11.0035, 11.0135, 11.0235, 11.0435 MHz.

Tram XL5 and Belcom S-8655. Existing crystals: 7.4625, 7.4725, 7.4825, 7.5025 MHz.

UT122E, Gemtronics 2325 and 3325, Scooper 9000. Existing crystals: 11.000, 11.050, 11.100, 11.150, 11.200, 11.250 MHz.

The new crystals for these popular units are obtainable by adding 1.335 MHz to the existing crystals. The outline on how to modify the Hygain V should be a guide to modifying some of the above units. The above guide comprises only a small number of the frequency synthesised units which may be modified for 10 metres, following the basic ideas outlined.

ADDING AN ADDITIONAL CHANNEL

Most 23-channel selector switches are able to provide an additional channel on a blank position, usually between channels 22 and 23. When connected, the channel is known as channel 22A — 28.570 MHz. With three additional connections, this can easily be obtained on the Hygain V and similar units. VK3NAU shows how this can be done on his Midland 13-892 in fig. 1.

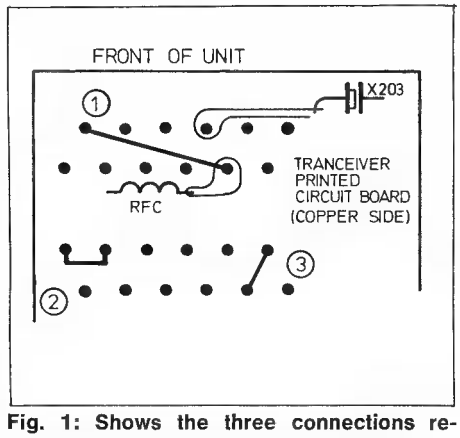

Fig. 1: Shows the three connections required between and within the six rows of crystal terminals on the copper side of the printed circuit board.

OPERATING ON 10 METRES

28.500 MHz is a popular listening channel in Sydney, Melbourne and Adelaide, with 28.550 MHz being monitored in Brisbane. Both these frequencies carry WIA broadcasts in various states. In Sydney 28.5 MHz is being used as an all mode calling channel. Contacts are established on USB, CW or AM and usually change to a lower channel to continue the contact. Worldwide DX communications is normally carried out in the channels from 28.5 to 28.590 MHz.

OPERATING HAND-HELD OR BACK PACK PEDESTRIAN

Many of the 1 watt and 5 watt hand-held AM units are easily modified onto 10 metres. Some hand-held units are frequency synthesised and can thus cover all 23 channels (e.g. Realistic TC101 5 watt, 23-channel, hand-held) other units use the two crystals per channel system and can be fitted with 28.3, 28.4 and 28.5 MHz crystals which are available. Using such a hand-held on 11m AM when that band was available, I was able to contact a station in Perth just by calling CQ. Such 2000 mile contacts on low power AM will often be easy to experience on 10 metres during summer and mid-winter sporadic E periods. Operating the Hygain V as an over the shoulder hand-held or as a back pack pedestrian, portable can be achieved by obtaining a 5½ ampere hour motor bike battery. These are light weight, only cost $14, and will supply power for a long period before recharging is necessary. A visit to a camping or disposals store should locate for you a small carrying pack to hold the rig, battery and an 11m helical which can be shortened for use on 10m. 5 foot helicals can be shortened to 4½ feet and mounted as high up in the carrying pack as possible. Some 7 feet of wire can be used as the ground plane. Connect one end to the earth connection on the helical antenna mount and make one loop around your tummy. Twist this loop some 6 times and tighten the loop around your waist. Let excess wire hang down by your side. To experiment with the SWR, change the position of the helical in the carrying pack and vary the number of twists on the loop. An SWR of under 1.5 to 1 should be obtainable after a bit of experimenting. Carry an SWR meter in the pack so that SWR can be monitored occasionally whilst operating. Using this kind of set up whilst walking up to my local hamburger shop with my 10 metre portable, I have been able to have some very good contacts into Tasmania, Queensland and South Australia. My aim is to work all Australian States while walking pedestrian hand-held back pack both on SSB and AM.

VFO FOR 10 METRES

Modified CB transceivers offer an opportunity for a whole range of experimentation in modifications and additions. VK3AIH has been successful in designing a VFO for the units similar to the Hygain V which he hopes to describe in AR soon. Work is also progressing on a 160 metre transverter which can take advantage of the portable and mobile nature of modified CB equipment. ■

MORE ON MODIFYING 11 Mx TRANSCEIVERS

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Many CB transceivers can be modified on to 10 metres by either changing a bank of 6 or a bank of 4 crystals in the frequency synthesiser circuit.

In the August 1978 issue of Amateur Radio Sam VK2BVS described what was involved in changing the bank of 6 crystals. I shall describe what is required if one wishes to change the bank of 4 crystals.

The advantages in changing the bank of 6 crystals is that it saves you the cost of 2 crystals for only the addition of a capacitor and a realignment.

This article should help complete the newcomers' understanding of the basic techniques in modifying frequency synthesised 11 metre sets on to 10 metres.

Currently advertisements are appearing in Electronic Australia and AR indicating the interest in using modified CB gear as an approach for the newcomer to amateur radio.

The modification applies to a wide range of CB units using 14.907, 14.917, 14.927 and 14.947 MHz crystals such as the Kraco KB255, the Hygain V, the Midland 13-892, and a host of others — just check on the circuit diagram.

The circuit numbers given refer to the Kraco KB2355 base station but the principle applies for the others mentioned. The above crystals are designated X206 to X210 inclusive. See details below.

L202: Crystal synthesiser mixer collector (38 MHz output).

L203, L204: 1st, 2nd bandpass tuned circuits — collector of 38 MHz amp.

L2, L3: 1st, 2nd bandpass tuned circuits — collector of xx 27 MHz mixer.

L4: Tx preamp. collector crt.

L5: Tx driver collector crt.

TC201-TC204: 14 MHz crystal trimmers.

L13, L14: Rx 7 MHz mixer collector — bandpass tuned crts.

L15: Input of 16 MHz amp.

L16, L17: Output of 16 MHz amp — bandpass circuit.

L18: Rx RF amp. input crt.

L19: RX RF amp. output crt.

1. Replace crystals X207, X208, X209, X210.
2. Turn L202, L203, L2, L3, L4 and L5 half a turn out.
3. Fit dummy load to antenna socket.
4. Select AM mode and key transmitter. At this stage there should be a slight indication on the RF power meter. If not, trim L202 slowly until there is. If there is still no indication, use a CRO to tune each stage individually.
5. Monitoring on RF power meter:
   Peak L202 on Ch. 12.
   Peak L203 on Ch. 17, Peak L204 on Ch. 6 — bandpass.
   Peak L2 on Ch. 17, Peak L3 on Cr. 6 — bandpass.
   Peak L4 on Ch. 12.
   Peak L5 on Ch. 12.
6. Trim TC201, TC202, TC203 and TC204 for correct channel frequency (trims new crystals).
7. Re-trim L202, L203, L204, L2, L3, L4, L5.
8. Fit 33 pF capacitor to L13 and L14 — these coils must tune down from nearly equal to 7 MHz or 6 MHz which is outside the range of the tuning slug.
9. Wind L15 half a turn out and select LSB.
10. Apply 1 kHz tone to mic (or whistle into it). Key transmitter and trim L13 until output is seen on Ch. 17 (only very silght indication on meter).
11. Peak L13 on Ch. 17.
    Peak L14 on Ch. 6.
    Peak L15 on Ch. 12.
    Peak L16 on Ch. 17.
    Peak L17 on Ch. 12.

Transmitter is now tuned on all modes.

RECEIVER ADJUSTMENTS

1. Select Ch. 12 and provide signal to aerial socket. (I sat a sig. gen. several feet from rig without any actual connection).
2. Select AM mode.
3. Trim L18 and L19 for max. indication on S-meter on a centre channel.
4. Check other channels for equal sensitivity.
5. Select LSB.
6. Select Ch. 17 and apply signal to aerial.
7. Re-trim L13 and L16 for best S-meter reading (these coils have been trimmed before but this allows finer adjustment).
8. Select Ch. 6 and apply signal to aerial.
9. Re-trim L14 and L17 for best S-meter reading.
10. Select Ch. 12 and apply signal to aerial.
11. Re-trim L15 for best S-meter reading.

Transceiver is now ready for use on 10m.

Note the Kraco mobile model uses different coil markings for L201, L202, L203, L204 as a different circuit board is used.

Some set commercially available commence with Ch. 1 as 28.310 MHz and Ch. 23 as 28.6 MHz. This means that channel numbering is one off the WIA 10m channel numbering system, which has Ch. 1 as 28.3 MHz and Ch. 23 as 28.590 MHz.

With the wide publicity of the WIA system on 10m, commercial suppliers are conforming to the WIA system. Those who are using crystals 16.252, 16.262, 16.272 and 16.292 which were supplied commercially in large numbers (up to 300 sets) will find this table handy for referring to the WIA channel numbering system.

WIA Channel Numbering System	Equivalent Numbering on 28.310 to 28.6 MHz sets	Frequency
1	—	28.3
2	1	28.31
3	2	28.32
—	3	28.33
4	—	28.34
5	4	28.35
6	5	28.36
7	6	28.37
—	7	28.38
8	—	28.39
9	8	28.40
10	9	28.41
11	10	28.42
—	11	28.43
12	—	28.44
13	12	28.45
14	13	28.46
15	14	28.47
—	15	28.48
16	—	28.49
17	16	28.5
18	17	28.51
19	18	28.52
—	19	28.53
20	—	28.54
21	20	28.55
22	21	28.56
22A	22	28.57
—	22A	28.58
23	—	28.59
—	23	28.600

This table should help to overcome confusion by allowing those using channelized equipment to be able to refer to the standardized WIA 23 channel numbering system.

Crystals X207, X208, X209, X210 should be on 16.242, 16.252, 16.262 and 16.282 MHz to conform to the WIA system. These are available for $4 each from Jan Crystals in the USA (see details in the Aug. 1978 AR article).

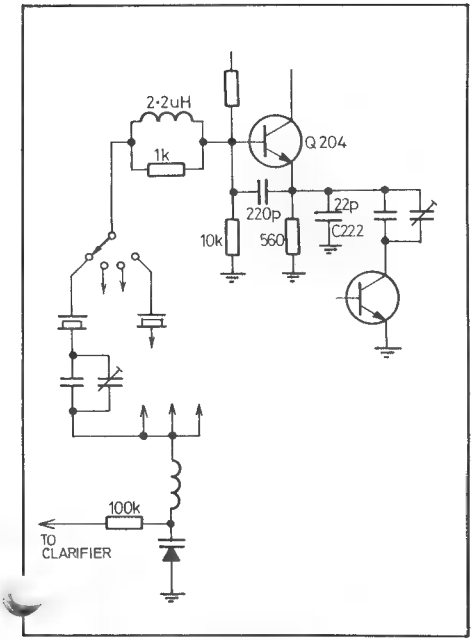

FIG. 1: Original Circuit

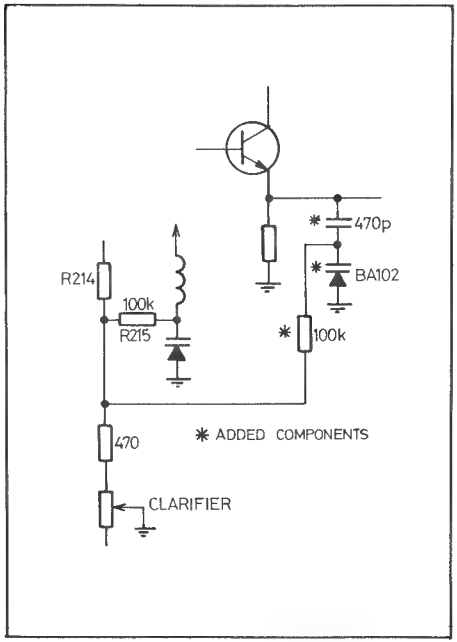

FIG. 2: Modified Circuit

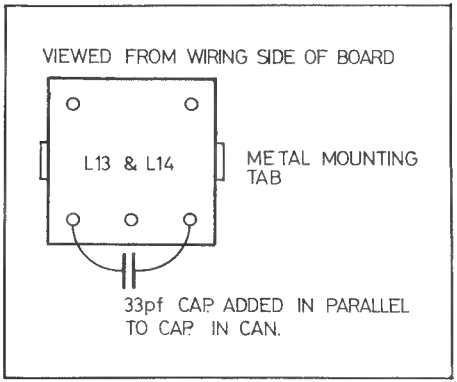

FIG. 3: IF Coil Details

ADDING VERSATILITY TO YOUR MODIFIED SET ON 10 METRES

Normally CB sets are fixed frequency and provide ±800 Hz clarification on receive. Here is a way of going transceive over ±4 kHz on each of the 23 channels.

MODIFICATION TO ACHIEVE ± 4 Hz CLARIFICATION

1. Remove C222 and replace with 470 pF capacitor, leaving earth end disconnected.
2. Connect BA102 varicap diode between free end of 470 pF capacitor and earth (anode to earth).
3. From junction of BA102 and 470 pF capacitor connect 100K resistor to junction of R215 and R214.
4. Disconnect wire from top of clarifier pot and connect to wiper so as to allow variation of transmit frequency. The clarifier will now vary both your transmit and receive simultaneously. All you do is adjust your "fine tune" or "clarifier" control.

Note: The above modifications will cause non-linear control of the frequency. This could possibly be cured by replacing clarifier pot with log. type. ■